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⑤④ A cordless electric device having improved contact means.

⑤⑦ A cordless electric tool in which a motor (not shown) is mounted in a housing (15, 16) and to which housing (16) a battery source (62) is connected to operate the motor. The battery source (62) is in the form of a battery pack (30) that will be slide-fitted into the housing (16) to be detachably connected thereto. The tool housing (16) has a hollow portion or cavity (36) which receives the battery pack (30). The motor has a pair of motor terminals (48, 50) which extend into the cavity (36) to mate with coacting battery terminals (58, 60) of the battery pack. Resilient means, preferably an "O"-ring (68) yieldably engages the motor terminals (48, 50) to increase the mechanical and electrical contact between the respective motor and battery terminals, (48, 50 and 58, 60).

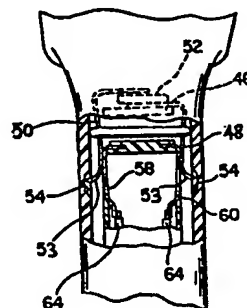


FIG. 8

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A cordless electric device
having improved contact means

The invention relates to a cordless electric device having improved contact means, such as a cordless electric power tool wherein the electric contacts are improved and comprising a housing, a motor
5 mounted in the housing and a battery source detachably connectable to the housing to operate the motor therein.

Cordless electric devices such as a power tool in
10 the form of a drill are known having a housing that receives a detachably connected battery pack wherein contact is repeatably made between the terminals of a motor and the battery pack to place the motor in circuit with the battery pack.

15 Cordless electric tools of the prior art have used rechargeable batteries as is shown in U.S. Patent No. 3,343,192. The rechargeable batteries can be mounted in a battery pack detachably connected to the hous-
20 ing of the cordless electric tool as is shown in U.S. Patent No. 3,999,110, owned by the owners of the present invention.

25 Connecting the battery in circuit with the motor of a cordless electric tool can be by a plug in a socket which is similar to the common approach associated with electrical wall outlets, or by various other types of connections in which the natural resiliency of a contact terminal is used to produce the desired
30 connection. However, due to one or more reasons, including manufacturing tolerances, wear, age or the like, such connections tend to fail at some point short of the expected life thereof.

The invention as claimed is intended to remedy this drawback and it is an object to increase the service life and reliability of the terminals and to decrease the wear thereof.

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It is also an object of the present invention to provide an improved cordless electric device which is simple, economical and reliable.

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The invention solves the problem of how to improve the contact means by providing the terminals with resilient means to increase the mechanical and electrical connection of the terminals.

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A cordless electric device according to the present invention, has a housing in which a motor is mounted and a battery source is detachably connected to the housing to operate the motor therein. A pair of motor terminals in the housing are connectable in

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circuit to a pair of battery terminals, respectively, of the battery source. The present invention provides a resilient means, which in the preferred embodiment is an "O"-ring, to increase the mechanical and electrical connection between the respective terminals

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which place the motor in circuit with the battery source.

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In the preferred embodiment of the present invention the improved cordless electric device is provided having a detachable battery pack and an "O"-ring at the battery terminals to increase the mechanical and electrical connection thereof; which terminals are electrically isolated and have the "O"-ring thereabout; which terminals extend into a hollow

portion of the housing; which terminals have bent
ends to facilitate the detachable connection with
the battery pack; and which housing has recesses
in the hollow portion in which the bent ends are
5 disposed upon connection of the battery pack.

The present invention has the advantage in that
existing devices may be readily modified so as to
include the resilient means in accordance with the
10 invention. The resilient means will be such that
the motor terminals are held without inducing
fatigue and may be readily spread apart by insertion
of the battery pack or source. Even in the spread
portion of the terminal, a positive force is provided
15 by the resilient means to ensure good electrical
contact between the motor and battery terminals to
thus reduce switch vibration and reduce heat build-
up at the terminals to reduce wear and improve
reliability.

20 The invention will be described further, by way of
example, with reference to the accompanying drawings,
in which:-

25 Figure 1 is a side elevational view, partly in
section, of a cordless electric drill embodying
the present invention;

Figure 2 is a view, partly in section, similar to
30 the handle portion of Figure 1 showing the battery
pack removed therefrom;

Figure 3 is a plan view of an "O"-ring embodied in
the present invention;

Figure 4 is an elevational view taken along line 4-4 of Figure 3;

5 Figure 5 is a bottom plan view taken along line 5-5 of Figure 2;

Figure 6 is a top plan view taken along line 6-6 of Figure 2;

10 Figure 7 is a bottom plan view, partly in section taken along line 7-7 of Figure 1;

15 Figure 8 is a side elevational view, partly in section, taken along line 8-8 of Figure 1;

In the illustrated embodiment of the invention a cordless electrical device, which in the preferred form is a power tool such as a drill or the like, designated generally as 10 is shown in Figure 1. The drill 10 has a chuck affixed to a rotary spindle 14 driven by a motor (not shown) mounted in a motor portion 15 of a housing 16 which has a depending handle 18 formed at the opposite end of the tool 10 from the chuck 12.

25 In a preferred embodiment the housing 16 is formed of a suitable plastics material, with the handle 18 having a front portion 20 and a rear portion 22 held together in clam shell fashion by screws 24, only one of which is shown in Figure 1. A trigger switch 26, having a lock and reverse button 28 is mounted in the handle 18 below the motor portion 15 of the housing 16. The trigger switch 26 is in circuit with the motor and when manually depressed will actuate

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the motor, upon a charged bottom pack 30 being connected within the handle 18 and latched in place via a pivotal latch member 32 affixed to the bottom of the front portion 20. The latch member 32 is released by depressing a release lever 34 connected to extend from the bottom of the bottom pack 30, and when the latch member 32 is connected it nests out of sight in a slot 35 formed in the front of the battery pack 30.

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The handle 18 shown in Figures 1 and 2 below the switch 26 has a chamber or cavity 36 surrounded by a thin wall 38 and open at the bottom 40 which has an enlarged boss 42 extending around three sides thereof. The boss is sized to smoothly blend into the enlarged lower portion 44 of the battery pack 30 when it is slid into and connected within the handle 18.

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The switch 26 defines the upper limits of the cavity 36 and has affixed thereto a mounting plate 46 shown in Figures 1, 5 and 8 from the opposite side of which extends a pair of motor terminals 48 and 50 electrically isolated from each other by dielectric member 52 and in contact with the switch 26. The terminals 48 and 50 extend downwardly into the cavity 36 a short distance from the adjacent wall 38 and parallel to each other as depicted in Figures 7 and 8. The ends 53 are bent outwardly aligned with a recess 54 formed in the wall 38 and normally spaced therefrom as shown in Figure 5 and when the battery pack 30 is inserted within the cavity 36, the upper portion 56 thereof which carries battery terminals 58 and 60 will mate respectively with

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motor terminals 48 and 50 to force the motor terminals 48 and 50 to spread apart causing the ends 52 thereof to enter the recesses 54, as shown in Figures 7 and 8.

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The battery pack 30 as best illustrated in Figure 2 includes an array of batteries 62 shown dotted therein and interconnected in series with a pair of lead wires 64 affixed separately to the battery terminals 58 and 60 respectively as shown in Figures 2 and 8. The upper portion 56 of the battery pack 30 defines a slide-in portion insertable within the cavity 36 wherein the battery pack 30 is latched by the latch member 32 received with the latch slot 35. The batteries 62 may be rechargeable nickel-cadmium, and after being charged the battery pack 30 is latch connected within the handle 18 of the housing 16 to place the tool 10 in a ready to operate condition.

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To extend the life of the respective terminals 48, 50 and 58,60 and improve the connection between the motor terminals 48, 50 and the battery terminals 58, 60 an "O"-ring 66 illustrated in Figures 3 and 4 is sized to fill up the space between the respective terminal 48 and 50, and the adjacent wall 38 prior to insertion of the battery pack 30. The "O"-ring 66 can thereafter be slightly squeezed to permit the closest contact between the mating motor and battery terminals 48-58 and 50-60, respectively whereby the mechanical pressure is increased and electrical correction therebetween is improved by the added contact pressure and contact area.

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The "O"-ring 66 yieldably holds the motor terminals

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48,50 closer to each other without inducing fatigue yet permits easy spread thereof upon the upper portion 56 being slide-fit within the cavity 36 to have the battery terminals 58,60 engaged therebetween. Even
5 in the spread position of the motor terminals 48,50 the "O"-ring 66 provides a positive force to ensure the best electrical contact between the motor and battery terminals 48-58 and 58-60 respectively. Such electrical contact reduces switch vibration and
10 permits a lower operating temperature at such contacts so as to prevent heat build-up and possible distortion of the plastics material housing components. Of course, this aids switch 26 life and added reliability to both the switch 26, the battery pack
15 30 and the tool 10.

It will be understood that various changes in the details, materials, arrangements of parts and operating conditions which have been herein described
20 and illustrated in order to explain the nature of the invention may be made by those skilled in the art without departing from the scope of the invention as claimed. For example resilient means may be provided additionally or more likely instead
25 of, battery terminals 58,60 to bias such apart into good contact with the motor terminals 48,50.

Claims

1. A cordless electric device having a housing (16), a motor (not shown) mounted in the housing (15 or 16) and a battery source (62) detachably connectable to the housing to operate the motor; wherein there are provided:
- 5 a) a hollow portion (36) formed in the housing (16) and adapted removably to receive the battery source (62) therein;
- 10 b) a pair of terminals (48,50) electrically isolated (52) from each other and in circuit with the motor extending into the hollow portion (36) with
- 15 c) each of the terminals (48, 50) in spaced relationship with the other terminal (50,48) and adapted to make individual electrical contact with the battery source (62); characterised by the feature that
- 20 d) resilient means (66) are provided yieldably engaging a pair of terminals (48,50) to provide an increased mechanical and electrical connection between said terminals (48,50) and the respective battery source (62 via 58,60).
2. A device as claimed in claim 1 characterised by the feature that there are provided:
- 25 a) the resilient means defines an "O"-ring (66) made of dielectric material, and
- 30 b) the "O"-ring (66) encircles the pair of terminals (48,50) continuously to urge said terminals (48,50) toward each other whereby upon connection with the battery source (62) the mechanical and the electrical connection therebetween will be increased.

3. A cordless electric device having a motor (not shown) mounted in a housing (16), a control switch (26) in circuit with the motor to operate the motor, and a battery source (62) connectable to the housing, wherein there are provided
- 5 a) a hollow portion (36) formed in the housing (16)
- b) a pair of motor terminals (48,50) individually in circuit with the motor with
- c) the motor terminals (48,50) extending into the hollow portion (36) in predetermined spaced relationship to each other,
- 10 d) a battery pack (30) detachably connected to the housing (16) and having the battery source (62) therein,
- 15 e) an insertion portion (56) formed in the battery pack (30) and said portion receivable within the hollow portion (36),
- f) a pair of battery terminals (58,60) spaced from each other on opposite sides of the insertion portion (56) and individually in circuit with the battery source (62),
- 20 g) the pair of battery terminals (58,60) and the pair of motor terminals (48,50) to mate in individual pairs, respectively, upon the battery pack (30) being connected to the housing (16), and characterised by the feature that there are provided
- 25 h) a resilient means operatively (66) associated with one of the pairs of terminals (58, 60 or 48, 50) to urge each of said terminals into increased mechanical and electrical connection with the
- 30 respective mating terminal thereof (48,50 or 58,60).

4. A device as claimed in claim 3, characterised by the feature that there are provided:
- 35 a) the resilient means defines an "O"-ring (66)

made of dielectric material, and

- b) the "O"-ring (66) encircles the motor terminals (48,50) continually to urge the motor terminals (48,50) toward each other, and momentarily to yield upon engagement therewith by the respective battery terminals (58,60).

5. A device as claimed in claim 4 characterised by the feature that there are provided:

- a) the hollow portion (36) had oppositely facing walls (38)
- b) each of the motor terminals (48,50) extends along one of the walls in spaced relationship thereto and,
- c) the "O"-ring (66) extends adjacent the oppositely facing walls and upon connection of the battery pack (30) to the housing (16) the motor terminals (48,50) urge the "O"-ring in the direction of the adjacent walls.

6. A device as claimed in claim 5 characterised by the feature that there are provided:

- a) the motor terminals (48,50) define parallel legs electrically from each other, and
- b) each of the legs have a free end (52) bent in the direction of the adjacent walls.

7. A device as claimed in claim 6 characterised by the feature that there are provided:

- a) a recess (54) is formed in each of the walls corresponding to the free end (52) of the respective legs whereby upon connection of the battery pack (30) to the housing (16) the motor terminals (48,50) are expanded to force the free ends (52) thereof into the respective adjacent recesses (54).

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8. A device as claimed in claim 7, characterised by the feature that there are provided:

a) each of the motor terminals (48,50) have straight legs extending into the hollow portion (36),

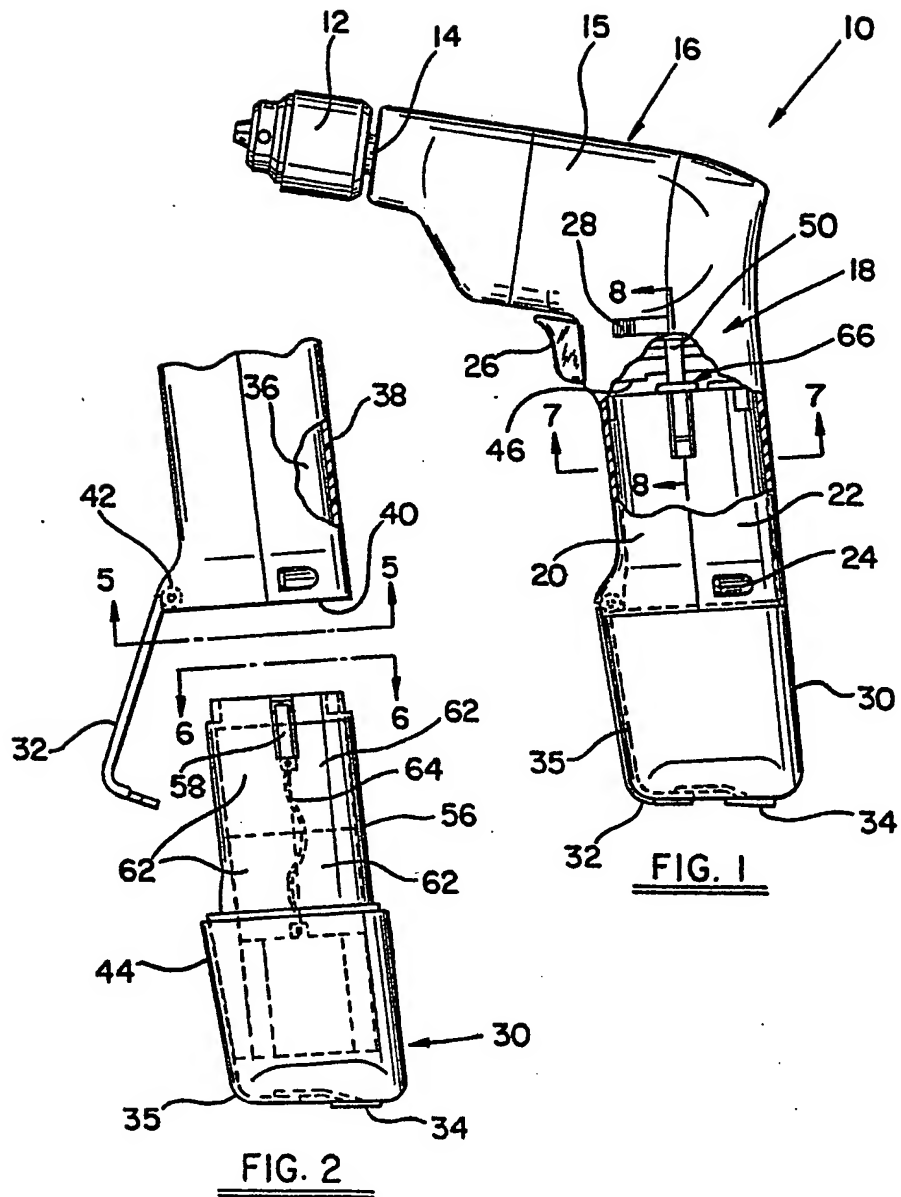
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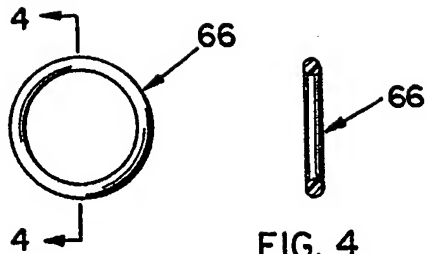
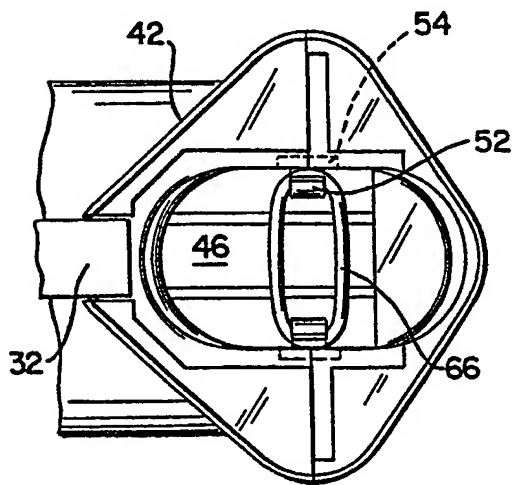
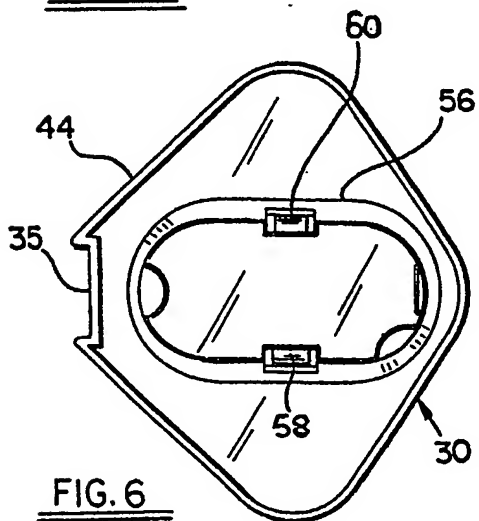
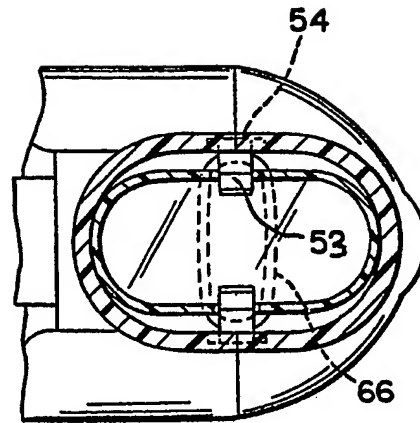
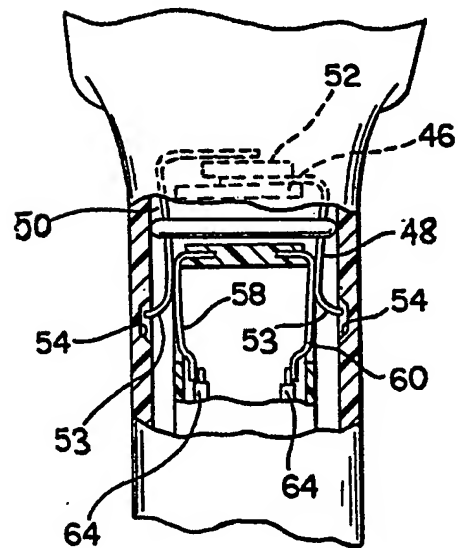
b) the free end (52) of each leg is bent away from each other toward the adjacent walls, and

c) the "O" ring (66) is sized to fit within the space between the respective motor terminals (48,50) and the adjacent wall (38) and to be squeezed against said wall upon connection of the battery terminals (58,60) to the motor terminals (48,50).

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FIG. 3FIG. 4FIG. 5FIG. 6FIG. 7FIG. 8